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CASE REPORT

Retraction of the upper maxillary incisors with corticotomy-facilitated orthodontics and mini-implants



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Abstract This report describes a case of 21-year-old female with severe maxillary protrusion, and class /1 dental relationship. The treatment plan was extraction of upper first premolars and retraction of the anterior teeth. Mini-implants were used to provide maximum anchorage to maintain the extraction space. To shorten the retraction time selective alveolar corticotomy was combined with orthodontic therapy. The treatment time was reduced without any adverse effects on the periodontium and the vitality of the teeth.

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1. Introduction

Adult patients who seek orthodontic treatment often desire that their treatment be completed in a short period of time.¹² However, adult patients with severe overjet requiring maximum anchorage usually require at least 2 years of active treatment.²² One possible method for completing treatment in a shorter period is through an orthodontic treatment combined with corticotomy.^{17,6,2,19}

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Corticotomy is defined as the osteotomy of the cortical bone.¹⁰ In adult patients, this technique reduces the treatment time because the resistance of the dense cortical bone to orthodontic tooth movement is removed.⁵ Wilcko et al. have noted that orthodontic tooth movement is accelerated by the increase of bone turnover and decrease of bone density,²⁰ because osteoclasts and osteoblasts are increased by a regional acceleratory phenomenon [RAP]⁴ after the corticotomy.

Anchorage loss often produces insufficient treatment results, particularly in patients who require maximum anchorage.

With the introduction of mini-plates^{16,1} micro-implants and mini-screws/implants^{14,13,15} as anchorage, it has become possible to achieve absolute anchorage.⁸

Therefore, an orthodontic treatment combined with corticotomy and placement of mini-implants may provide the advantage of shortening the orthodontic treatment period in maximum anchorage cases. However, there have been few case reports in which such a therapy was performed.

2. Case report

2.1. Case summary

The patient's chief concern was the protruding incisors, and her goal was complete retraction of the anterior teeth. Extra-oral examination revealed a convex profile, right nasolabial angle and a gummy smile. Radiographic evaluation revealed a slightly increased mandibular plane angle, proclined upper incisors and a slight increase in the lower facial height. The panoramic radiograph shows normal anatomical structures.

2.2. Diagnosis

A 21-year-old female presented with class molar and canine relationships, with anterior overjet of 8 mm, severe protrusion of the upper anterior teeth, a moderate deep bite, and a four mm anterior overbite. Radiographic examination showed a skeletal class relationship with severe underlying Sagittal jaw discrepancy.

Orthognathic surgery was not desired by the patient, because of the general anesthesia and the high-cost of this surgical approach. The selective extraction of two permanent maxillary first premolar teeth was considered acceptable. Because of the patient concern of the treatment period, we suggested a minimal invasive selective alveolar corticotomy under local anesthesia to shorten the treatment time and the patient agreed.

2.3. Treatment objectives

Decision was made to start a compromised treatment, so the objectives included the following: (1) align and level teeth in both arches, (2) reduce the upper teeth protrusion, (3) achieve class canine relationship and ideal overjet and overbite.

2.4. Treatment plan

Based on the patient complaint and the clinical and cephalometric findings, the following treatment plan was formulated:

(1) Placement of full maxillary and mandibular fixed appliances, (2) implantation of two mini-implants between the maxillary first molar and second premolar, (3) extraction of the first premolars combined with selective alveolar corticotomy, (4) mini-implants were used for maxillary en masse anterior

retraction to obtain maximum anchorage, and (5) finishing with fixed appliance.

2.5. Treatment progress

Fixed preadjusted Roth appliance (0.022*0.028 slot) was used. After leveling and alignment, two orthodontic mini-implants (Svenska Ortho-cut, Sweden) self drilling type, conical shape with 1.6 mm diameter and 8 mm length were implanted into the buccal alveolar bone between first molars and second premolars (Fig. 1).

The upper first premolars were designated for removal at the same appointment of the surgery.

2.6. Surgical procedure

The corticotomy was carried out under local anesthesia. A full thickness mucoperiosteal flaps were reflected both labially and lingually around all the upper anterior teeth (canine to canine), except for the lingual aspect of the interdental papilla between the maxillary central incisors (Fig. 2). Vertical bone cuts in the cortical bone were made about 1–2 mm below the alveolar crest and were extended 2–3 mm beyond the apices of the anterior teeth, these cuts were performed both facially and lingually from the distal of the right upper lateral incisor to the distal of the left upper lateral incisor with 1 mm diameter ceramic bur (Komet, Germany). The cuts extended only about



Figure 2 Extension of the palatal flap.

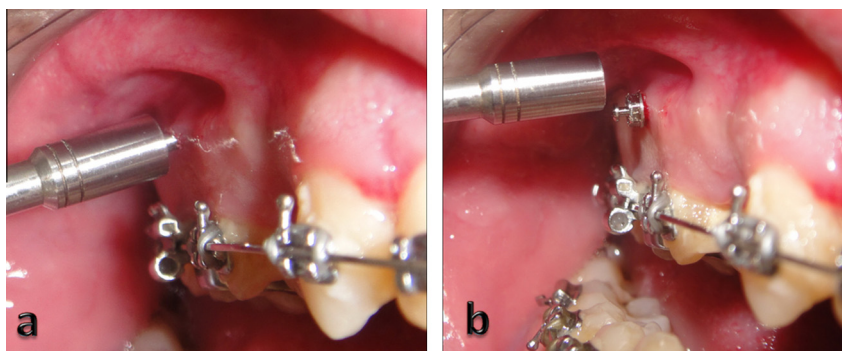


Figure 1 (a) Placement of mini-implant. (b) Mini-implant after placement.



Figure 3 Labial view of the alveolar corticotomy.

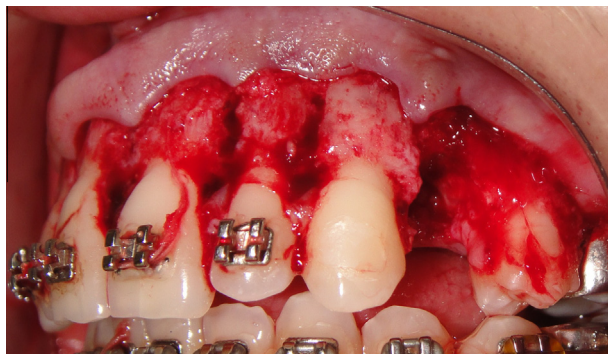


Figure 4 Osteotomy at the first bicuspid space.

1.5 mm to the superficial aspect of the medullary bone, by confirming healing through the cut lines (Fig. 3).

After the extraction of the upper first bicuspid, osteotomies were performed at the site of the bicuspid, care was taken to extend the osteotomies as close as possible to the apices of the upper canines without encroaching on the lining of the maxillary sinuses. Extensive bone thinning was performed on the distals of the canines leaving little more than the PDLs, lamina dura, and the thinnest layer of the medullary bone possible (Fig. 4).

The bone was thinned on the linguals of the upper canines and upper incisors. After bleeding control the flaps were repositioned and sutured into place with interrupted loop 3-0 silk sutures (Fig. 5).



Figure 5 Flaps after suturing (palatal view).

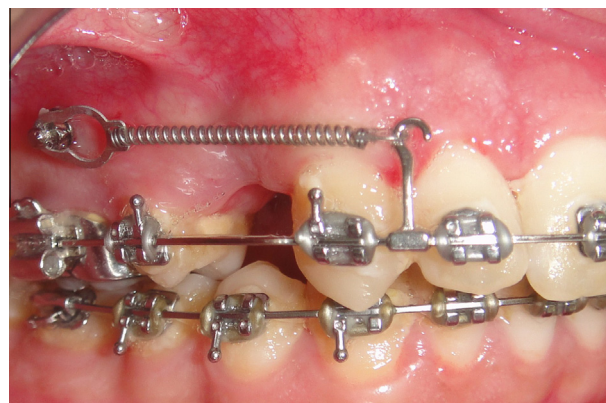


Figure 6 En masse retraction with closed coil springs.

A 0.019*0.025-inch St.St arch wire with anterior hooks was placed in the same appointment. After 2 weeks, sutures were removed and St.St closed coil springs were used from the maxillary mini-implants to the hooks and the six anterior teeth were retracted simultaneously with orthopedic forces of 450 g/side²¹ (Fig. 6).

The patient was examined at 2 weeks interval for reactivation of the retraction force. The en masse movement was finalized in 4.5 months. A Hawley retainer and a bonded retainer were applied full time to the maxillary and mandibular arch, respectively. The total treatment time was 16 months.

2.7. Treatment results

The patient showed acceptable occlusion, owing to the successful retraction of the upper anterior teeth. The dental arches were well coordinated and ideal overjet and overbites were achieved (Fig. 7).

Cephalometric superimposition before and after treatment showed no mesial movement of the maxillary molars (Fig. 8). According to the cephalometric tracings, there was a significant change in the SNA angle as shown in Table 1.

During the active treatment, no significant periodontal problems, such as gingival recession or loss of tooth vitality, and no looseness of the mini-implants were observed. Panoramic radiographs before and after treatment showed no significant reduction in the crest bone height and no marked apical root resorption (Fig. 9).

3. Discussion

It is well known that therapy with corticotomy shortens the period of conventional orthodontic treatment.^{17,6,3,7} In the current case report, the total orthodontic treatment time (16 months) was dramatically reduced when compared with the average treatment time for extraction therapy (31 months).^{18,9}

In corticotomy-facilitated orthodontics, the reduction of orthodontic treatment time by approximately 50% was observed.⁵

The earlier concept of rapid tooth movement was based on bony block movement in corticotomy techniques including buccal and lingual vertical and subapical horizontal cuts circumscribing the root of the teeth.^{17,10} On the other hand, the

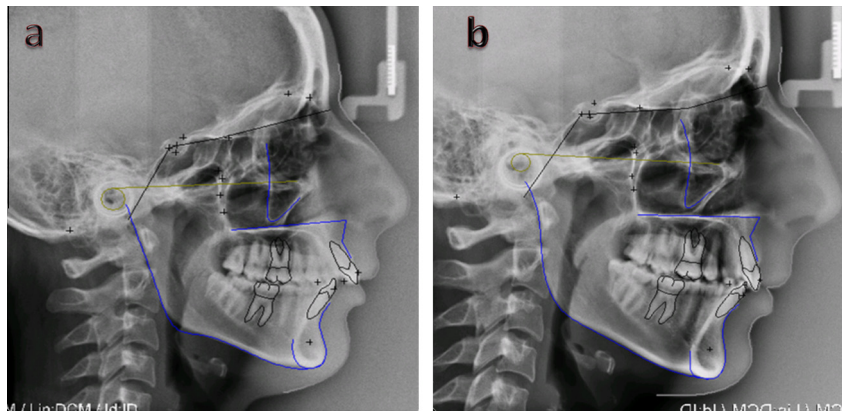


Figure 7 (a) Cephalometric tracing before treatment. (b) Cephalometric tracing after treatment.



Figure 8 Before retraction (a) Intra-oral buccal view, (b) intra-oral palatal view. After retraction (c) intra-oral buccal view, (d) intra-oral palatal view.

latest concept on the rapid tooth movement after corticotomy is supported by the regional acceleratory phenomenon (RAP), described as accelerated bone turn over and decreased regional

bone density.¹⁹ Osteoclasts and osteoblasts are increased by RAP after fracture and surgery such as osteotomies, and calcium depletion will occur.⁴

Closing spaces in posterior areas require moving the teeth in the mesiodistal orientation of the alveolus. Lino et al. have clearly shown that the insult of circumscribing corticotomy cuts alone will not produce an osseous response that is sustainable enough to permit movement of tooth roots through large amount of bone in the mesiodistal orientation of the alveolus.¹¹

Tooth movement can only sustain post-corticotomy surgery if a thin layer of bone is present over the root surface in the direction of the intended tooth movement.²¹ Additionally, continued tooth movement prevents tissues immediately adjacent to the root from remineralizing and that is the reason why the reactivation was done every 2 weeks.

In the presented case, accomplishing en masse retraction movement in the most efficient manner possible will require

Table 1 Cephalometric measurements.

Cephalometric value	Initial	Final	Normal
SNA	85.7	81.4	82 ± 2
SNB	78.5	78	80 ± 2
ANB	7.2	3.4	2 ± 2
SN/MP	33	32	32 ± 4
B	29.5	28	25 ± 5
U1/Spp	65.9	69.2	70 ± 5
U6-PTV	23.4	24	—
Witts	6.8	4	0 ± 2
Nasolabial angle	89	95	85–90



Figure 9 Profile picture. (a and b) Before retraction. (c and d) After retraction.

a considerable amount of alveolar preparation at the extraction site space. To provide a very thin layer of bone over the entire length of the distal root surface of the canine we require osteotomy in the area previously occupied by the root of the first bicuspid, leaving a very thin layer of the bone over the entire length of the distal canine root.

Orthopedic forces (450 g/side) were used because it is more efficient than orthodontic forces.²¹ The initiation of the space closure was delayed for 2 weeks to allow the thin layer of the bone to demineralize. In opposition to “Periodontally Accelerated Osteogenic Orthodontics” (PAOO) technique, described by,²¹ no bone grafting material was included in the treatment, because no sign of dehiscences or fenestrations over the roots of the anterior teeth was observed and the roots were not moved beyond their physiological borders.

The use of mini-implants in this case was necessary to retract the anterior teeth with absolute anchorage of maxillary molars in order to improve severe upper teeth protrusion. The superimposition of pre-and post treatment cephalometric radiographs showed no mesial movement of the maxillary molars.

During the active treatment, anchorage loss or inflammation in the peri-implant soft tissue, or looseness of the mini-implant was not observed even with the use of heavy orthodontic forces.

In the current case, no significant reduction in the crest bone height, decrease of attached gingiva, marked apical root resorption, or devitalization was observed after the orthodontic treatment.

4. Conclusion

A corticotomy-facilitated orthodontic treatment with mini-implants may be an effective method for maximum anchorage cases in adult patients who desire a shortened orthodontic treatment period.

5. Conflict of interest

None.

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